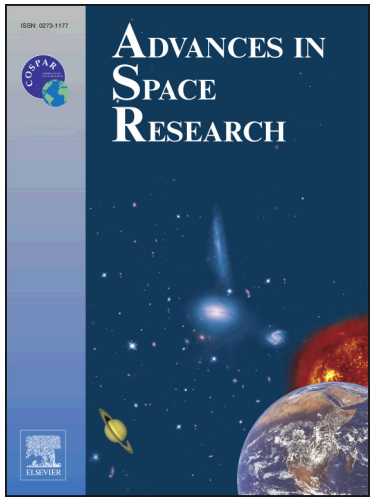

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Integer aperture estimation in the presence of biases

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Abstract: Ambiguity validation is a quality control step for ambiguity resolution. It is realized by integer aperture (IA) estimator and critical value determination approach. During the past decades, most of research about IA estimator were mainly implemented by numerical simulation. The influence of biases to IA estimation has not been studied. Actually, ambiguity resolution is subject to various kinds of biases in practice, which influences the performance of IA estimation. In this contribution, properties of IA estimators are investigated when they are biased. The probability evaluation formulae for IA estimators with bias-affected are derived and verified. The proper ways to evaluate biased-IA estimators are recommended by numerical experiments. In addition to this, the influences of atmospheric biases to IA estimation are analyzed in different experiments. Those results show that under the same influence of biases, all IA estimators have no better positioning precision than integer estimator, and different IA estimators may lead to different positioning precision. A better choice of IA estimator may lead to less loss of positioning precision. However, if biases can be properly separated, positioning precision of integer and IA estimators can be greatly improved. Hence, the adaptation of biases is more important than the choice of IA estimators in positioning and other applications.

Keywords: GNSS; Ambiguity resolution; Integer aperture estimator; Biases

1. Introduction

Precise positioning, including relative positioning and point precise positioning (PPP), has been widely used in geodesy, navigation, integrity monitoring and geohazard early warning(Misra and Enge 2006). In relative positioning, ambiguity resolution is the most important part to achieve centimeter precision. As to PPP, ambiguity resolution is necessary if users want to achieve faster convergence and more precise positioning results(Laurichesse, Mercier et al. 2009, Zhang and Teunissen 2011).

Ambiguity validation is of importance step to realize quality control for ambiguity resolution, which is realized by the so-called integer aperture (IA) estimator. In the past years, various IA estimators were proposed and studied. In order to apply these IA estimators into practice, especially instantaneous cases, several approaches have been introduced, including look-up table (Verhagen and Teunissen 2013) for ratio test and iCON (Zhang, Wu et al. 2015) for several IA estimators. Detailed comparisons of both approaches can be referred to (Zhang, Wu et al. 2016) and (Li, Zhang et al. 2015). However, all the investigation about IA estimators takes no regard of biases. Actually, biases are very common in practice and may have severe influence to parameter estimation. The influence of biases to integer estimation is theoretically investigated in (Teunissen 2001), which mainly focuses on the derivation of probability evaluation and bounding

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